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Multi-method Performance Measurement for Marine Corps J-79 Jet Engine Mechanics

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Patricia A. Alba
The Texas MAXIMA Corporation
San Antonio, Texas 78209

Herbert George Baker
Navy Personnel Research and Development Center
San Diego, California 92152-6800

Reviewed by
Gerald J. Laabs

Released by
John J. Pass
Director, Personnel Systems Department

Navy Personnel Research and Development Center
San Diego, California 92152-6800

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This report details the pilot administration of a Job Performance Measurement Package designed to assess first-term U.S. Marine Corps (USMC)J-79 jet engine mechanic job proficiency. The data collection reported herein completes an important inter-service transfer of testing technology, a cooperative effort between the Air Force and the Navy. The findings of an order of administration effect hold important implications for future research in job performance measurement throughout the domain of industrial-organizational psychology.

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FOREWORD

This research was conducted within the Navy Job Performance Measurement Program, part of the Congressionally mandated Joint-Service Job Performance Measurement/Enlistment Standards Project, funded primarily under Project Element Number 63707N (Manpower Control System Development) and Project Number Z1770 (Manpower and Personnel Development).

This report details the pilot administration of a Job Performance Measurement Package designed to assess first-term U.S. Marine Corps (USMC) J-79 jet engine mechanic job proficiency. The data collection reported herein completes an important inter-service transfer of testing technology, a cooperative effort between the Air Force and the Navy.

Information contained herein is intended to benefit the Navy and Marine Corps, the Joint-Service Project, and the research community. In particular, the findings of an order of administration effect hold important implications for future research in job performance measurement throughout the domain of industrial-organizational psychology.

JOHN J. PASS
Director, Personnel Systems Department

SUMMARY

Background

The Armed Services are participating in a Congressionally mandated project to link enlistment standards to job performance. Consequently, performance data must be gathered, analyzed, and related to selection and classification criteria. Economical performance measures are needed to complete this work. Therefore, a set of performance measures using different measurement methods must be developed and evaluated.

Problem

Each measure in a set of performance measures must be evaluated as an appropriate indicator of technical proficiency. In addition, because the order in which the different performance measures are administered may vary for administrative and logistical reasons, sequencing effects must also be evaluated.

Objectives

Within the global context of developing measures of job performance, this study focused on the administration of multi-method measures of the individual job proficiency of U.S. Marine Corps (USMC) first-term J-79 jet engine mechanics, and the evaluation of the performance measurement package on a number of dimensions. Specific objectives were to: (1) complete a demonstration of the feasibility of transferring testing technology between services, (2) evaluate the several performance measures in terms of user acceptability, and (3) analyze effects of the order of administration of the hands-on and surrogate measures.

Approach

Four types of performance measures were administered to 44 USMC jet engine mechanics (MOS 6024): (1) a hands-on job sample test; (2) an interview test; (3) proficiency ratings at the self, peer, and supervisor levels; and (4) a paper-and-pencil job knowledge test (JKT). The first three measures were originally developed by the Air Force for their jet engine mechanic specialty and subsequently adapted for use by the naval services as part of an interservice technology transfer. The fourth measure, the JKT, was developed by the Navy. The measures were administered such that half of the test subjects took the JKT first and half, the rest of the test package first.

Results

Order of administration effects were found. Scores were affected by the method of measure, the tasks being evaluated, and the administration sequence. There were no significant two-way interactions between task and sequence. The JKT produced the highest scores and the interview component produced the lowest scores in both the before and after administration groups.

Of the three types of measures adapted from the Air Force, the hands-on component was ranked by incumbents as the best instrument for providing accurate and useful information about a jet engine mechanic's performance. The interview tests and rating forms were ranked second and third respectively.

Other user-oriented information collected from test subjects and supervisors included judgments of: (1) the comparative accuracy, discrimination, and acceptability of the various ratings forms; and (2) the degree to which job proficiency can be tapped by hands-on tests.

Conclusions

1. The elements of the Navy/Marine Corps JPMS and the JKT appear to exhibit sufficient variance in individual performance.

2. Interview test items are appropriate for first-term jet engine mechanics when the incumbents have all engine parts in view and the task procedures are relatively short and uncomplicated.

3. There is evidence of significant order of administration effects among different parts of the measurement package.

4. The sample included 56.5 percent of the total Marine Corps active duty, first-term J-79 jet engine mechanic population. Nevertheless, the small sample size militates against strong generalization from the data at hand.

Recommendations

1. The J-79 performance measurement package should be made available to potential users such as reserve components or allied forces employing airframes that incorporate the J-79 engine.

2. Order of administration effects should be taken into account in all future research using multiple measures of performance.

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INTRODUCTION

Problem

Each measure in a set of performance measures must be evaluated as an appropriate indicator of technical proficiency. In addition, because the order in which the different performance measures are administered may vary for administrative and logistical reasons, sequencing effects must also be evaluated.

Objectives

Within the global context of developing measures of job performance, this study focused on the administration of multi-method measures of the individual job proficiency of Marine Corps first-term J-79 jet engine mechanics, and the evaluation of the performance measurement package on a number of dimensions. Specific objectives were to: (1) complete a demonstration of the feasibility of transferring testing technology between services, (2) evaluate the several performance measures in terms of user acceptability, and (3) analyze effects of the order of administration of the hands-on and surrogate measures.

Background

Under Congressional mandate, the Department of Defense (DoD) is conducting a Joint-Service Job Performance Measurement (JPM)/Enlistment Standards Project aimed at linking performance on the job to the services' selection and classification processes. In this project, the services are developing hands-on performance measurement techniques for selected specialties unique to each service.

Job performance is a complex phenomenon, one of the major aspects of which is technical proficiency. The latter is the current focus of Joint-Service Project research. For a more extensive description of the Joint-Service Project and the Navy's JPM research program, refer to Laabs and Berry (1987).

Performance tests are extremely time consuming and costly to develop. Consequently, in an attempt to effect fiscal and temporal economies in performance measurement, the services are pursuing a number of cost-reduction strategies. One is the development of surrogate measures. In that effort, hands-on tests are the "bench mark" or standard against which potential surrogates (e.g., paper-and-pencil tests, rating scales, simulations, etc.) are evaluated.

In addition to investigating surrogates, each service is developing measures for at least one specialty comparable across services, to evaluate the potential for technology sharing. As part of that effort, this study was undertaken to assess the feasibility of transferring the measurement technology developed by one branch of the armed forces to another branch.

A jet engine mechanic performance measurement package was developed by the Air Force (Hedge, 1984) to measure the performance of jet engine mechanics assigned to the J-79 flight line or shop maintenance activities. The Air Force test package consisted of a comprehensive performance assessment system including: rating forms at the self, peer, and supervisor level and a walk-through performance testing (WTPT) that integrated hands-on and interview testing. The package was supplemented by questionnaires eliciting background data, user acceptability, and so forth.

In 1985, pursuant to a tri-service cooperative endeavor, the Air Force transferred its J-79 test package to the Navy for use in evaluating J-79 jet engine mechanics in the naval services. The deletion of the airframe employing the J-79 engine resulted in there being no first-term Navy jet engine mechanics available for testing, and only a few such personnel in the Marine Corps. Nevertheless, the data collection and analyses were conducted in order to gather all available performance information, as well as to fully gauge the usefulness of the transferred test package.

The transfer itself went smoothly and proved both the feasibility and cost effectiveness of projects of that type. Details of the technology transfer and the development of the resulting Navy/Marine Corps jet engine mechanic test package may be found in Baker, Blackhurst, and Alba (1987)

In support of the Navy's own investigation of potential surrogates for hands-on testing, a paper-and-pencil job knowledge test (JKT) was developed to augment the adapted Air Force test package.[1] A description of the procedures used to develop the JKT is given in Appendix A.

For administrative and logistical reasons, data collection on the JPM project often involves test subjects taking either the hands-on or a surrogate test first. The impact of such procedures must be addressed to ensure that performance is not confounded with practice, which would affect the findings of the JPM research such as the relationship between ASVAB and on-the-job performance. Because the JKT was administered before the WTPT to half the job incumbents and after the WTPT to the other half, this study provided the opportunity to examine the effects of order of administration.

APPROACH

Subjects

All Marine Corps J-79 jet engine mechanics (MOS 6024) with 13 to 48 months of active duty service and stationed in the continental U.S. or Hawaii were eligible for evaluation (N = 65). However, factors such as overseas deployment, medical problems, and temporary duty assignments reduced the number available for testing, already quite low due to the phase out of the airframe employing the J-79 engine, to a total of 44 incumbents.

Data were collected at four Marine Corps Air Stations and one Air Force Base. J-79 mechanics were drawn from both the Intermediate- and Organizational Maintenance Activity (IMA/OMA) levels, which parallel the Air Force flight line and shop levels. The sample included 1 American Indian, 2 Blacks, and 41 Caucasians. The average length of time as a jet engine mechanic on the J-79 engine was 22 months. All incumbents were male. Table 1 shows the number and percentage of incumbents by rank.

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[1]Copies of the adapted Air Force test package and the JKT may be requested from Navy Personnel Research and Development Center.

Table 1

Sample of Jet Engine Mechanics

Rank	Pay Grade	Number	Percent
PFC	E-2	2	4
LCPL	E-3	26	59
CPL	E-4	16	36

Measures

Performance measures included those transferred and adapted from the Air Force, augmented by the JKT. Table 2 shows the list of measures; samples of each measure are contained in Appendix B.

Table 2

List of Measures

Type	Title
Performance	**Walk Through Performance Testing (WTPT)** • Hands-on component • Interview component
	Overall Performance Rating (OPR)
	Rating Forms (completed by incumbent, peer, and supervisor) • Global rating form • Dimensional rating form • Task rating form • Navy/Marine Corps wide rating form
	Job Knowledge Test (JKT) • IMA form • OMA form

Auxiliary	**Questionnaires**
	• General utility/acceptability questionnaire (GUAQ)
	• Background information questionnaires
	  • General background questionnaire
	  • Rating form questionnaire
	  • Task experience rating questionnaires

Walk-through Performance Test (WTPT)

The WTPT is a task-level job performance measurement instrument incorporating both a hands-on component and an interview component.

The hands-on component was administered in the work setting, being a traditional job sample designed to measure performance on a set of critical job tasks.

The interview component was added as a means of addressing critical tasks that would have been eliminated due to constraints such as risk of personal injury or equipment damage. Interview testing also took place in the work setting and required the evaluator to assess an incumbent's proficiency on a task by asking questions designed to uncover knowledge and procedural strengths and weaknesses related to the performance of that task. The incumbent was permitted to answer the questions by a combination of verbal responses, gestures, and demonstrations.

Both the WTPT hands-on and interview test items were administered from a printed assignment/score sheet, with yes-no markings signifying correct or incorrect step completion. Point deductions were made for step errors with each step weighted by the mean rating given by subject matter experts of step criticality on a 9-point scale.

An examinee's total WTPT score was obtained by summing the scores of 10 hands-on and 5 additional interview items. Each item was valued at 10 points; thus total scores could range from 0 to 150 points. Figure 1 summarizes the WTPT scoring procedure.

Total WTPT Score

- Range 0 to 150 Points
  - 15 Tasks (10 hands-on, 5 interview)
  - Total score for an individual = sum of all task scores

Task (Item) Score)

- Range 0 to 10 points
  - X number of steps
  - Deductions made for errors based on individual step score
  - Total task score = 10 minus the total number of points deducted for step errors

Step Score

- Range varies depending on criticality and number of steps in task
  - Criticality rated by subject matter expert (SME) using 9-point scale (1 = low; 9 = high)
- Establish step scores:
  - Calculate a mean SME criticality rating for each step
  - Sum the step mean values
  - Divide each step mean value by the sum of the mean values
  - Multiply by 10 to get error deductions per step

Figure 1. Scoring the WTPT.

Rating Scales

Subjectively derived overall performance ratings (OPR) comprised another part of the test package. The ratings were assigned upon completion of every WTPT hands-on and interview task, but were not included in the total WTPT scores. The OPRs were treated as a separate, more global method of measuring performance, to be compared to the WTPT scores. That is, the ratings were subjective evaluations of overall performance and did not necessarily reflect the number of steps missed on a given task. The evaluators considered such factors as attitude, speed, number of attempts to complete the task steps, safety, as well as successful task completion. The ratings were based on a scale from 1 to 5 as follows:

5 Far exceeded the acceptable level of proficiency.
4 Somewhat exceeded the acceptable level of proficiency.
3 Met the acceptable level of proficiency.
2 Somewhat met the acceptable level of proficiency.
1 Was far below the acceptable level of proficiency.

Four rating forms completed the package adapted from the Air Force. The following ratings were completed at self, peer, and supervisor levels: (1) the Global rating forms (technical and interpersonal competence), (2) the Dimensional rating form (occupational specialty behavioral items), (3) the Task rating form (task specific measures (e.g., installing or removing components)), and (4) the Marine Corps-wide rating form (military related performance factors (such as leadership and integrity)). The rating scales were behaviorally anchored and ratings were on a 5-point scale from 5 (high) to 1 (low). Scoring was by summation.

Job Knowledge Test (JKT)

The Navy-developed JKT, a paper-and-pencil simulation, differed from most paper-and-pencil tests in that it used photographs as reference points and required the examinee to: (1) identify components in the photographs, and (2) select procedures that would normally be followed when performing various tasks.

The JKT included 10 tasks or items paralleling the hands-on test. Each task had a number of "questions" or elements to which the examinee responded. Each task was worth 10 points. All questions were scored as either correct or incorrect. Total JKT score was obtained by summing the 10 task scores after deductions were made for errors on the individual questions. Error deduction points were calculated for each task by dividing 10 by the total number of questions in the task.

Examples of JKT scoring procedures:

JKT Task 373 had 15 questions
Task 373 Error Deduction Points = (10/15)
Task 373 Error Deduction Points = .666

If an examinee missed three questions on JKT task 373, task score = 10 - (.666 * 3) - 1.998 = 8.002.

Auxiliary Measures

A General Utility Acceptability Questionnaire (GUAQ), also adapted from the Air Force system, was used to collect examinee evaluation of the fidelity and understandability of the entire test package. Scoring was by summation.

Three other questionnaires were also administered. These obtained background and experience information as well as incumbent, supervisor, and peer opinions on the quality of the rating forms. Scoring was by summation. Taken together, all of the measures listed above constitute the Navy/Marine Corps performance measures package.

Test Items

Items contained in the JPMS are displayed in Figure 2. Each of these test items was addressed by one or more of the instruments.

1.	Install P&D valves
2.	Install ABFP valve
3.	Complete forms
4.	Inspect engine plumbing
5.	Inspect trailer
6.	Install bleed air system
7.	Install anti-icing duct
8.	Install EGT harness
9.	Install ignition exciter box
10.	Install lockwire
11.	Rig afterburner components
12.	Rig inlet guide vane systems
13.	Install #3 bearings (IMA task)
14.	Install #3 oil seals (IMA task)
15.	Remove turbine rotors (IMA task)
16.	Isolate fuel malfunctions (OMA task)
17.	Source of high oil consumption (OMA task)
18.	Install CSD assemblies (OMA task)

Figure 2. Test items contained in the JPMS.

Hands-on Tasks

Items 1, 3, 4, 5, 6, 7, 8, 9, 10, and 11 shown in Figure 2 were those of which performance was measured by hands-on tasks.

Common Test (Overlap) Items

Five test items are in common across the hands-on, the interview, and the job knowledge tests. This provides for comparison of the measures and the evaluation of the JKT as a surrogate for hands-on testing. These are called "overlap" items. Figure 3 graphically illustrates the overlap. The remaining items are unique to the particular instrument.

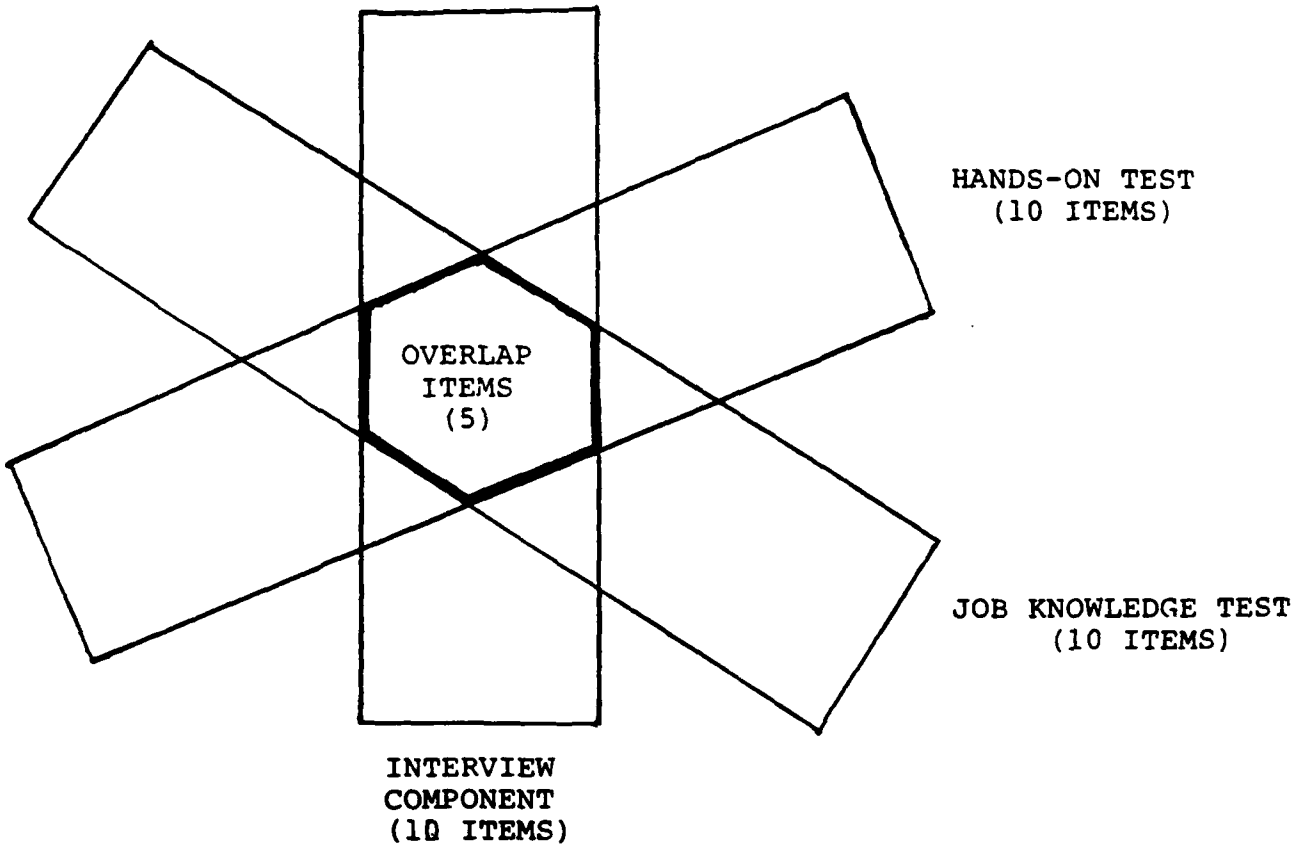

Figure 3. Overlap items.

In addition, because there are slight differences in the duties of differently assigned maintenance personnel, each of the rating scales and the JKT were developed in both IMA and OMA forms. (Refer to Baker et al., 1987, for further details.) Both JKT and the rating scales were based on the hands-on tasks, and subject matter experts judged the IMA and OMA tests to be equivalent.

Procedures

Rating forms and questionnaires were group administered to the incumbents, their immediate supervisors, and one co-worker (peer) in a classroom setting on the first day. (A rater training session preceded rating form administration.) Time required was approximately 3.5 hours. Allowing 8 hours per subject, the WTPT and the JKT were individually administered in the jet engine power plant on the second day and as many days thereafter until all subjects were evaluated. The JKT, as noted earlier, was administered to half the test subjects before the WTPT and after the WTPT to the other half. The GUAQ was individually administered each day, after completion of the WTPT and the JKT. Total testing time per individual was 1 1/2 days. Background data were collected from individual service records.

RESULTS AND DISCUSSION

Scores were obtained on all instruments for performance at the task and total score levels. In addition, sub-scores were generated on several of the measures. However, the small sample size precluded meaningful analyses of the relationships between the measures at the task level as well as relationships between performance on the various measures and scores on the ASVAB.

Multi-method Performance Measurement

For purposes of a gross comparison of jet engine mechanic job proficiency as captured by the various measurement methods, only total scores were used. These total scores included: (1) WTPT; (2) WTPT hands-on component; (3) WTPT interview component; (4) ratings by self (incumbent), peer, and supervisor (for the 10 tasks contained in the hands-on test); and (5) JKT. Overall descriptive statistics for results attained on the various measures are displayed in Table 3.

Table 3

Descriptive Statistics for Components of the Multi-method Performance Measurement

Component/Performance Levels	Mean	SD
WTPT (Total)	106.76	13.68
WTPT (Hands-on)	75.54	8.97
WTPT (Interview	65.31	10.41
Rating (Self)	38.31	6.22
Rating (Peer)	37.57	7.37
Rating (Supervisor)	37.47	7.38
JKT	41.21	3.24

Walk-through Performance Testing (WTPT)

Scores were generated for each of the 10 hands-on and 10 interview tasks. Five of the interview tasks duplicated or overlapped five of the hands-on tasks; the other five tasks were different, depending on duty assignment. Table 4 displays descriptive statistics for IMA and OMA duty assignments. Using only the common hands-on/interview items, the student's t-test revealed nonsignificant differences between the two groups. The combined (IMA/OMA) mean hands-on score for the overlap items was 38.04, while for the five interview overlap items the combined mean was 34.08.

Table 4

WTPT Total and Hands-on Scores for IMA and OMA

	Min	Max	Mean	SD
IMA (N = 28)				
WTPT total	85.95	133.86	106.43	10.31
10 hands-on (Bench mark)	66.98	90.30	77.79	5.39
OMA (N = 16)				
WTPT total	77.03	133.80	107.35	18.12
10 hands-on (Bench mark)	49.47	90.18	71.59	12.07

Overall Performance Rating (OPR)

Recall that at the time of test administration, the administrator assigned an OPR to the incumbent's performance on each of the hands-on and interview tasks. The correlation of the OPR means with their corresponding hands-on and interview mean scores were all positive and significant, ranging from a low of .57 for the task Install Lockwire to a high of .88 for the task Isolate Fuel Malfunction.

Rating Forms

Rating forms addressing a number of performance areas were administered at the incumbent (self), peer, and supervisor levels. The mean of the Global, Dimensional, Navy/Marine Corps wide and 11 task mean ratings are reported for the IMA and OMA combined. Mean ratings over items for each of the four types of ratings by each of three sources are shown in Table 5. Means ranged on the individual items from a low of 2.71 to a high of 4.57.

Job Knowledge Test (JKT)

Table 6 displays the descriptive statistics for the JKT total score, the five JKT/interview/hands-on overlap sub-scores, and the five JKT/interview non-overlap sub-scores by activity. IMA JKT total scores ranged from 75.03 to 93.19, and OMA total scores ranged from 66.61 to 87.50.

Table 5

Grand Mean Ratings Over Four Forms by Three Sources

	Source		
	Self	Peer	Super
Global	3.92	3.94	3.80
Dimensional	3.75	3.71	3.54
Task	3.78	3.73	3.73
Navy/Marine Corp wide	3.58	3.58	3.48

Table 6

Job Knowledge Test Descriptive Statistics

	N	Min	Max	Means	SD
		IMA			
10 JKT total	28	75.03	93.19	83.13	4.54
5 JKT/Interview/Hands-on	28	38.33	47.67	42.20	2.59
5 JKT/Interview	28	34.81	45.97	40.93	2.55
		OMA			
10 JKT total	16	66.61	87.50	76.57	5.54
5 JKT/Interview/Hands-on	16	30.89	44.89	39.53	3.54
5 JKT/Interview	16	33.15	42.61	37.03	2.06

Using only the common hands-on/interview/JKT items, the students' t-test revealed a significant difference between the two groups. Using only the common (overlap) tasks, the combined mean JKT score for the overlap items was 41.21.

Results of Administration Sequence

Tasks were evaluated by three methods: interview, hands-on, and JKT. The interview component, which was part of the WTPT, was always administered immediately before the hands-on component. The JKT, which took approximately 1 hour to administer, was administered before and after WTPT to 28 and 16 incumbents, respectively. Both before and after groups contained IMA and OMA mechanics. Eighteen IMA and 10 OMA mechanics took the JKT before WTPT; 10 IMA and 6 OMA incumbents took the JKT after WTPT.

Using the data from the five overlap items only, analyses of variance (ANOVA) were conducted to compare: (1) the sequence of administration, and (2) the five item scores. The relationship between sequence and task/item was examined separately for each of the three methods used: interview, hands-on, and JKT. Tables 7, 8, and 9 summarize the results of these analyses for the interview, hands-on, and JKT methods, respectively.

Table 7

Summary Table: ANOVA
(Interview Method)

Source	df	SS	MS	F	p
Main Effects	5	188.5	37.7	13.9	<.01
Task	4	156.5	39.1	14.4	<.01
Sequence	1	32.0	32.0	11.8	<.01
Interaction					
Task/Sequence	4	10.2	2.5	.9	.44
Explained	9	198.7	22.0	8.1	<.01
Residual	210	568.1	2.7	---	---
Total	219	766.9	3.5	---	---

Table 8

Summary Table: ANOVA
(Hands-on)

Source	df	SS	MS	F	p
Main Effects	5	369.0	73.8	19.1	<.01
Task	4	349.1	87.2	22.6	<.01
Sequence	1	19.9	19.9	5.1	.02
Interaction					
Task/Sequence	4	11.8	2.9	.7	.54
Explained	9	380.8	42.3	10.9	<.01
Residual	210	809.6	3.8	---	---
Total	219	1190.5	5.4	---	---

Table 9

Summary Table: ANOVA
(Job Knowledge)

Source	df	SS	MS	F	p
Main Effects	5	134.2	26.8	16.7	<.01
Task	4	123.5	30.8	19.3	<.01
Sequence	1	10.6	10.6	6.6	.01
Interaction					
Task/Sequence	4	7.3	1.8	1.1	.33
Explained	9	141.6	15.7	9.8	<.01
Residual	210	335.9	1.6	---	---
Total	219	477.5	2.1	---	---

Main Effects

Review of Tables 7 through 9 indicates significant differences among tasks and between sequence for each of the three methods. Task and sequence means by method are displayed in Table 10.

Table 10

Task and Sequence by Method

	Interview		Hands-on		Knowledge	
Task	Before	After	Before	After	Before	After
R1	6.7	5.2	7.1	5.8	8.2	8.7
134	8.0	7.7	6.2	6.1	6.4	7.4
353	8.0	7.2	8.9	8.2	8.2	8.8
360	6.2	5.3	7.2	6.3	8.3	8.8
373	6.4	6.0	9.5	9.4	9.0	8.8
Mean	7.1	6.3	7.8	7.1	8.0	8.5

The sequence in which the knowledge test was administered (before or after interview/hands-on) appears to have an effect on examinee's scores on both the hands-on and interview portions of the WTPT. On the other hand, the JKT was also affected by the testing sequence, in that mean knowledge scores for the "after" group are higher than the mean knowledge scores for the "before" group. In group comparisons, these effects would likely cancel each other, which is the intended effect of counterbalancing. When test performance data is to be related to a set of predictors, however, the individual scores must be on a common metric. In the present case, rank ordering of individuals may

change depending on what instrument among the interview, hands-on test, and job knowledge was administered first.

Although it is impossible to assess with the present design, hands-on test scores may have been elevated by exposure to "interview" test items in the WTPT in addition to the job knowledge test items.

Thus, the problem of sequence effects is exacerbated in a multi-method performance measurement package. Our results suggest that multiple exposures to similar subject matter regardless of measurement method will tend to increase examinee scores and this must be taken into account in future performance measurement efforts.

Questionnaires

Incumbents responded to the rating form, experience (as a J-79 mechanic and on particular tasks), background, and acceptability questionnaires. Peers and supervisors responded to the rating form and background questionnaires.

Experience Questionnaire

IMA personnel indicated they had been jet engine mechanics for an average of 26 months with an average of 24 months in the IMA shop. OMA mechanics averaged 20 months as jet engine mechanics and 15 months in the OMA shop. The IMA group reported more experience than the OMA group for 10 of the 12 common IMA/OMA tasks, less experience for the remaining two tasks. Table 11 shows the mean experience reported by each group for each of the 12 common IMA/OMA tasks. The difference in experience may explain the better performance of the IMA groups previously illustrated in Tables 4 and 6.

Table 11

IMA and OMA Mean Task Experience for the 12 Common IMA/OMA Tasks
(IMA N = 28, OMA N = 16)

Task No.	Task Description	Type	Mean Experience IMA	Mean Experience OMA
R1	Install P&D valve	Hands-on	4.07	3.38
R2	Install ABFP valve	Interview	4.46	3.25
134	Complete VIDS MAF	Hands-on	3.25	4.56
301	Inspect engine plumbing	Hands-on	5.21	4.06
302	Inspect trailer	Hands-on	3.21	4.31
349	Install bleed air comp	Hands-on	5.50	3.75
353	Install anti-icing duct	Hands-on	4.61	2.56
360	Install EGT harness	Hands-on	4.71	2.69
363	Install exciter box	Hands-on	3.64	2.88
373	Install lockwire	Hands-on	6.75	5.88
385	Rig afterburner comp	Hands-on	4.82	3.44
387	Rig inlet guide vane system	Interview	3.50	2.75

Note. Underline indicates more experience; Scale: 1 = No Experience, 7 = A Very Great Amount of Experience.

Rating Form Questionnaire

Incumbents, peers, and supervisors were asked to rate and rank the four rating forms for accuracy, discrimination, and acceptability, and to indicate how motivated they were to complete the rating forms. Table 12 shows the self, peer, and supervisor rating form questionnaire mean ratings and rankings of the four different forms.

Table 12

Rating Form Questionnaire Mean Ratings and Rankings By Source
(N = 44)

Ratings (1 = Low; 5 = High)	Source		
	Self	Peer	Supervisor
How motivated	3.30	3.05	3.82
Accuracy of Rating Form:			
Global	3.77	3.30	3.73
Dimensional	3.73	3.41	4.07
Task	3.80	3.36	3.89
Navy/Marine Corps	3.55	3.27	3.70
Discrimination of Rating Form:			
Global	3.39	3.07	3.25
Dimensional	3.55	3.25	3.57
Task	3.61	3.34	3.61
Navy Marine Corps	3.23	3.02	3.50
Acceptability of Rating Form:			
Global	3.30	2.93	3.14
Dimensional	3.43	3.11	3.59
Task	3.45	3.14	3.64
Navy/Marine Corps	3.16	2.95	3.34
Accuracy of Rating Form:			
Global	3.0 = 4	3.0 = 4	3.0 = 4
Dimensional	2.4 = 2	2.1 = 2	2.2 = 2
Task	1.8 = 1	1.7 = 1	2.0 = 1
Navy/Marine Corps	2.9 = 3	2.3 = 3	2.6 = 3
Discrimination of Rating Form:			
Global	2.8 = 4	2.9 = 4	2.8 = 4
Dimensional	2.7 = 3	2.2 = 2	2.4 = 2
Task	1.9 = 1	1.8 = 1	1.9 = 1
Navy/Marine Corps	2.6 = 2	2.2 = 3	2.6 = 3
Acceptability of Rating Form:			
Global	3.0 = 4	3.0 = 4	3.1 = 4
Dimensional	2.6 = 2	2.1 = 2	2.1 = 2
Task	1.7 = 1	1.6 = 1	1.9 = 1
Navy/Marine Corps	2.8 = 3	2.5 = 3	2.7 = 3

Motivation. All three sources indicated that they were motivated to complete the rating forms, with supervisors indicating the highest motivation. Peers, who, interestingly enough, turned out to be the best predictors of the incumbents' test performance, reported the least motivation to complete the rating forms.

Discrimination. All raters believed that they could discriminate between good and poor performers by responses to any one of the four rating forms. All sources gave a "moderate" to "great extent" discrimination rating for all four rating forms.

Accuracy. All three sources gave a "moderate" to "great extent" rating for accuracy of the Global, Task, and Marine Corps-wide rating forms. The supervisor group responded with ratings of either "to a great extent" or "to very great extent" accuracy rating for the Dimensional rating form, while self and peer raters gave that form a "moderate" to "great extent" accuracy rating.

Acceptability. All but one acceptability rating fell between "moderate" and to "a great extent." The peer raters gave a "small" to "moderate" rating for acceptability of the Global and Navy/Marine Corps-wide rating forms.

Rankings. All three sources ranked the Task rating form as the best for accuracy, discrimination, and acceptability, and the Navy/Marine Corps-wide rating form third for accuracy and acceptability. Incumbents (self) ranked the Navy/Marine Corps-wide rating form and the Dimensional rating form second and third respectively for discrimination, with peers and supervisors ranking the two forms in reverse order. All three sources ranked the Global rating form fourth in accuracy, discrimination, and acceptability.

General Utility/Acceptability Questionnaire

Incumbents were asked to rate the usefulness of the JPM System components in terms of accuracy and performance discrimination. Table 13 shows the mean responses.

Incumbents indicated that they believed that job proficiency could be determined by the hands-on component to a "very great extent," by the rating forms to a "small extent," and by the interview to a "moderate extent." Incumbents believed that the hands-on tests were acceptable to a "great extent" and that the interview and rating forms were acceptable to a "moderate extent."

The incumbents indicated that they were most motivated to complete the hands-on test and least motivated to complete the rating forms. Incumbents indicated that they were prepared from a "moderate" to "great extent" to complete the hands-on, interview, and rating forms. They believed the importance of the program was expressed from a "moderate" to "great extent." The incumbents were concerned to a "small extent" that the information being collected might be used for other purposes.

Incumbents ranked the hands-on component best for ability to provide accurate and useful information about a jet engine mechanic's performance. The interview tests and rating forms were ranked second and third respectively.

Table 13

General Utility/Acceptability Questionnaire
Incumbent Mean Ratings and Rankings
(N = 44)

	Rating	Ranking
Belief in:		
Rating forms	2.77	
Hands-on tests	4.07	
Interview tests	3.07	
Acceptability of:		
Rating forms	3.02	
Hands-on tests	4.07	
Interview tests	3.32	
Motivation to complete:		
Rating forms	2.80	
Hands-on tests	3.84	
Interview tests	3.23	
Preparation for:		
Rating forms	3.55	
Hands-on tests	3.95	
Interview tests	3.82	
Importance expressed	3.80	
Concerned	2.93	
Rating forms	3.48	3
Hands-on tests	1.25	1
Interview tests	2.68	2

Note. Scales: Rating (1 = Low; 5 = High), Ranking (1 = Best; 3 = Worst).

Background Questionnaire

Table 14 shows the incumbent, peer, and supervisor opinions regarding the situational constraints in the work environment, motivation factors, and commitment. All three sources agreed that the technical manuals were understandable and available and that the jet engine mechanics were able to use their skills on the job. A sense of accomplishment, feeling that their jobs were important, and a belief that they performed their duties to the best of their ability were evidenced by the members of the three groups. The three sources believed that on-the-job training (OJT) provided the skills required to perform their jobs.

The three groups differed in their beliefs about tools being available when needed. Both incumbents and peers believed that their supervisors were concerned about them and that the supervisors gave them the support they required; the supervisors only slightly agreed on both issues. The supervisors agreed that they had self pride, job satisfaction, and a sense of responsibility, but peers and incumbents only slightly agreed that they possessed these three motivational factors. The supervisors agreed that the technical schools provided them with the skills that they needed for the job, but the incumbents and peers were more equivocal.

Table 14

Work Environment, Motivation, and Commitment Mean Ratings
(N = 44)

Item	Source		
	Self	Peer	Supervisor
Manuals understandable	4.09	3.85	4.18
Manuals available	4.16	4.27	4.25
Tools available	3.25	3.34	3.32
Able to use skills	4.18	4.15	4.66
Sense of accomplishment	4.16	3.98	4.14
Supervisor concerned	3.98	3.88	3.43
Supervisor gives support	4.00	3.90	3.66
Job interesting	3.95	3.93	4.61
Self pride	3.57	3.68	4.50
Job importance	4.09	4.05	4.82
Job satisfaction	3.73	3.71	4.18
Sense of responsibility	3.45	3.46	4.55
Perform duties to best of ability	4.36	4.24	4.75
Technical schools provided skills	3.32	3.27	4.70
On-the-job training provides skills	4.34	4.20	4.64

Note. Scale: 1 = Strongly Disagree, 5 = Strongly Agree.

Other Relationships

In the Joint-Service research strategy (Laabs & Berry, 1987), hands-on tests are the bench mark to which potential surrogates for hands-on tests must be compared. This, of course, may be done at the global or item levels, or both. The comparison of potential surrogates with each other may also prove useful. Unfortunately, given the sample size and the pronounced order of administration effects, this was not possible in the present study.

Again, given the sample size and the pronounced order of administration effects, it was not possible to correlate JPMS components with selection and classification factors such as incumbent background information (pay grade, high school completion (diploma, GED), J-79 school final course grade), or scores attained on the ASVAB.

Discussion

In this data collection on the performance of 44 Marine Corps J-79 jet engine mechanics, personnel were evaluated by means of a multi-method testing system: hands-on, interview, paper-and-pencil job knowledge, measures and performance ratings. The hands-on tests should be considered to be sound measures of performance since their content was directly linked to the step-by-step procedures required to perform each task.

The interview component appeared to have a stronger relationship than the rating form component with the hands-on component. Thus, the interview component may be a better discriminator of hands-on performance than the rating form component.

A possible explanation for the strange relationship between interview and hands-on may be related to the content and design of the interview items and to the amount of experience reported. Two of the OMA unique interview items required the incumbents to answer a series of questions related to two troubleshooting tasks. The procedures were similar to those actually performed on the job.

The other OMA unique item and seven IMA/OMA common interview items required the incumbents to recall and explain procedures performed on the engine's external parts. The incumbents could see and point to the appropriate engine parts while explaining the procedures of the nine tasks. All three of the IMA unique interview items required the incumbents to recall and explain complicated procedures performed on the engine's internal parts. The IMA incumbents were unable to see the parts and thus use them as reference points when attempting to explain the three IMA procedures.

Many incumbents, even some who had performed these tasks several times, were unable to respond correctly to the "show and tell" requirement. This did not necessarily mean that the mechanics were unable to read the publications and perform the hands-on tasks at an acceptable or better level of performance.

This leads to the belief that "show and tell" interview test items are appropriate for first-term jet engine mechanics when the incumbents have all engine parts in view and the task procedures are relatively short and uncomplicated. When the parts are hidden from the incumbent's view and the procedures are relatively long and complicated, some other method of evaluation should be developed or the task should be excluded from the evaluation procedure. One alternative would be to provide the subjects with pictures or drawings for reference points of the unobservable areas. (A more thorough evaluation of interview tests as surrogates for hands-on performance tests is being conducted by the Air Force.)

It is appropriate to note that the order in which the JKT and the hands-on/interview testing were administered was found to have definite effects. Scores were affected by the method of administration, the tasks being evaluated, and the JKT/WTPT administration sequence. The JKT produced the highest scores and the interview component produced the lowest scores regardless of the order of administration. There is no apparent reason for the significant difference in performance on the JKT between IMA and OMA personnel.

Of more far-reaching import are the questions of what is an acceptable surrogate for a hands-on (job sample) test (a question that must be decided at the Joint-Service level), and the relationship of the various measures to the ASVAB.

The sample of 44 included 56.5 percent of the total Marine Corps active duty, first-term J-79 jet engine mechanic population. This small sample size militates against strong generalization about the overall proficiency of jet engine mechanics or the relationship between ASVAB and OJT performance.

In the end, because of the small sample size, the most significant findings in this effort (besides the demonstration of interservice transferability of the performance measures) were the indications of order-of-administration effects. Because all of the

services are using surrogates along with hands-on tests, which may be administered in different sequences, practice effects should be controlled for.

CONCLUSIONS

1. The elements of the Navy/Marine Corps JPMS and the JKT appear to exhibit sufficient variance in individual performance.

2. Interview test items are appropriate for first-term jet engine mechanics when the incumbents have all engine parts in view and the task procedures are relatively short and uncomplicated.

3. There is evidence of significant order of administration effects among different parts of the measurement package.

4. The sample included 56.5 percent of the total Marine Corps active duty, first-term J-79 jet engine mechanic population. Nevertheless, the small sample size militates against strong generalization from the data at hand.

RECOMMENDATIONS

Because no active duty sample exists on which to conduct further research with these instruments, research on the JPMS for J-79 jet engine mechanics should be terminated. The J-79 JPMS should be made available to potential users such as reserve components or allied forces employing airframes that incorporate the J-79 engine. In one specific instance, copies of the test materials were forwarded to Headquarters, 4th Marine Air Wing (FMF), U.S. Marine Corps Reserve for possible use in USMCR J-79 jet engine mechanic performance measurement and skills certification. Future Navy JPM research should control for order of administration effects. Also, a study should examine whether certain tasks are better addressed by different types of measures.

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APPENDIX A

JOB KNOWLEDGE TEST DEVELOPMENT

JOB KNOWLEDGE TEST DEVELOPMENT

Test development usually requires preliminary work to select tasks that are representative of the job domain to be evaluated and organize those tasks into testable steps (or sub-tasks). For the development of the Jet Engine Mechanic JKT, however, neither of these efforts were required because the tasks were selected and analyzed during the development of the interview components of the Navy JPMS. (See Baker, Blackhurst, & Alba, 1987 for details of the JPMS.) Two forms of the JKT were developed, one for the intermediate maintenance activity (IMA) level and one for the organizational maintenance activity (OMA) level. Table A-1 lists the tasks that compose the two forms of the JKT.

Table A-1

Tasks Included in Navy/Marine Corps Job Knowledge Test
(IMA and OMA Forms)

Task	Task No.	IMA	OMA
Install lockwire	J373	X	X
Install pressurizing and drain valves	J R1	X	X
Install afterburner fuel pressurizing valves	J R2	X	X
Install anti-icing ducts	J353	X	X
Install Egt thermocouple harnesses	J360	X	X
Rig inlet guide vane system	J387	X	X
Complete forms	J134	X	X
Install constant speed drives	J351		X
Isolate fuel system malfunctions	J319		X
Determine source of high oil consumption	J325		X
Install number 3 bearings	J238	X	
Install number 3 oil seals	J239	X	
Remove turbine assemblies	J247	X	

In order to identify all of the appropriate steps for each of the tasks, the test developer and two SMEs assigned as trainers at Marine Corps Air Station Beaufort, South Carolina, reviewed the relevant Navy technical publications. False steps were also identified and served as step distractors for each task. Test items were written for both the IMA and OMA forms. Each form included 10 tasks. Seven items were common to both, and three items were unique.

Photographs for the JKT were taken at Naval Air Station, Dallas. The photographs depicted a J-79 jet engine, individual engine components, and the various materials used to remove or replace parts and sections of the engine. The components were photographed on and off the engine to allow for flexibility when developing the JKT items. Sizing of the photographs was conducted on site by the photographer, under the direction of an active duty jet engine mechanic SME and the test developer. Each photograph contained the appropriate component of the engine that the examinee was to identify during the testing situation, as well as at least two other components that served as test distractors for each task.

The tests items were arranged in a test book with the photograph(s) on the left page and the steps and distractors on the page to the right, so the examinee could view the photographs and respond to the questions without being required to turn the page. A short verbal scenario was provided at the top of each right-hand page (see Figure AF-1) to accompany the respective photo reference point and to set the stage for each task. Instructions indicated that the examinees were to record their responses on an answer sheet provided by the test administrator.

SCENARIO FOR TASK JR1: You have been instructed to install a pressurizing and drain (P&D) valve on the engine. The main oil cooler, compressor rear frame bracket and lines are already on the engine.

3. (I016) Which component on the picture to the left is the pressurizing and drain (P&D) valve? Write the matching letter on the answer sheet.

4. From the list below, select the actions or checks that you should take when installing the P&D valve. Place a check mark in the yes column of the answer sheet if you should perform the action. Place a check mark in the no column if you should not perform the action.

(I017) Lubricate the O-rings and seal with graphite grease prior to installation.

(I018) Install elbows, jam nuts, and O-rings on the large outlet and rear ports.

(I019) Leave the jam nuts finger tight until after the fuel manifolds are installed.

(I020) Install a clamp bracket between the P&D valve and the main oil cooler.

(I021) Install the valve in the correct position with the ports facing the appropriate lines.

(I022) Torque the four bolts holding the valve to the main oil cooler.

(I023) Safety wire all four bolts together in one series.

(I024) Install two bolts to secure the valve to the rear mounting bracket.

(I025) Install an O-ring, drain tube, O-ring, and connector bolt (in that order) in the drain port.

(I026) Torque the two bolts securing the valve to the rear mounting bracket.

(I027) Position the two large elbows to the rear and use a common screwdriver to align the fittings when installing the fuel manifolds.

(I028) Torque the jam nuts and manifolds, and lockwire.

(I029) Position the rear elbow and install the reference fuel pressure manifold tube.

(I030) Torque the jam nut and tube coupling and lockwire.

Figure AF-1. Example of job knowledge test.

U.S. Marine Corps SMEs reviewed the completed JKT for accuracy and understandability. A pilot test was conducted at Naval Air Station, Dallas by experienced test administrators who had received extensive training in test administration and had previously served in analogous testing of J-79 jet engine mechanics for an Air Force project.

The test was administered to three first-term jet engine mechanics, one from the organizational activity and two assigned to the shop maintenance areas. The test subjects were allowed as much time as necessary to complete the test. All three jet engine mechanics completed the JKT within 1 hour.

Subsequent to the pilot test, minor editorial changes were made and the JKT was printed and compiled for administration to jet engine mechanics assigned to USMC intermediate and organizational maintenance activities.

APPENDIX B

SAMPLE PAGES OF JOB PERFORMANCE MEASUREMENT SYSTEM

GENERAL BACKGROUND

YOUR
NAME _____ SSN _____ - _____ - _____

The following questions pertain to your work experience, your work unit, and your feelings about your job. This information will be used for research purposes only. Please check/fill in each blank as accurately as possible.

1. Present Rank/Rate:

_____ E-1	_____ E-5
_____ E-2	_____ E-6
_____ E-3	_____ E-7
_____ E-4	_____ E-8

2. Months in present unit: ____ ____

3. Months you have been a Jet Engine Mechanic on the J-79 engine model system : ____ ____

4. Area where most of your work is done: ____ IMA ____ OMA

5. Months in IMA: ____ ____; months in OMA: ____ ____

6. Please list any additional Jet Engine Mechanic experience below.

Engine Type	Amount of Experience (months)
_____	_____
_____	_____
_____	_____

7. In general, how is morale in your unit? (Check one)

____ Extremely high
____ Fairly high
____ Average
____ Fairly low
____ Extremely low

TURN SHEET OVER FOR ADDITIONAL QUESTIONS

Phase I J-79 Hands-On Task 349
IMA and OMA

Objective: To evaluate the incumbent's ability to install J-79 engine bleed air system components (manifold collector bowls).

Estimated Time: 30M Start: Finish: Time Req:

Time Limit: 45M #Times Performed: Last Performed:

Tools and Equipment: PUB: NAVAIR 01-245FDD-2-3-5, Pg 3-46, Tool Box, Petrolatum or Tape, 0-150 inch-pound Torque Wrench, 0-300 inch-pound Torque Wrench, one 50887-550S Conoseal, one MAO 06-005 Gasket.

Background Information: Evaluate on modified bleed air system.

Engine Configuration: The modified BLC system with the BLC ducts, the BLC support, and the short duct are installed on the engine. The cap and attachment hardware are removed from the manifold collector bowl. The manifold collector bowl is off the engine. Do NOT remove the bracket assembly from the engine (remove six o'clock bolt).

Instructions:

Administer in the shop. The incumbent may use the PUB. Hold the rig pin in while the incumbent tightens the rear end jam nuts. Show the incumbent the manifold collector bowl to ensure that he/she understands what component is to be installed.

SAY TO THE INCUMBENT

INSTALL THE BLEED AIR SYSTEM MANIFOLD COLLECTOR BOWL USING PUB NAVAIR 01-245FDD-2-3-5, PG 3-46 AS A GUIDE. FOLLOW GENERAL MAINTENANCE PROCEDURES AT ALL TIMES. TELL ME IF YOU PLAN TO DEVIATE FROM THE PUB.

Performed or Answered Correctly	Yes	No
Did the incumbent:		
1. Ensure that the conoseal gasket was installed with the gasket angle oriented with the flange face of the duct?	___	___
2. Position the collector coupling (V-Band clamp) split line at the 3 or 9 o'clock position with the bolt facing down?	___	___

Phase I J-79 Interview Task R1
IMA and OMA

Objective: To evaluate the incumbent's knowledge concerning the installation of pressurizing and drain (P&D) valves.

Estimated Time: 10M Start: Finish: Time Req:

Time Limit: 12M #Times Performed: Last Performed:

Tools and Equipment: PUB: NAVAIR 02B-105AGD-6-1 WP 119 00, P&D Valve, Tool Box.

Background Information: N/A

Engine Configuration: N/A

Instructions:

Administer in the shop by the engine. The incumbent may NOT use the PUB. Hand the incumbent the P&D valve before you read the instructions.

SAY TO THE INCUMBENT

WITHOUT THE USE OF THE PUB, TELL ME STEP BY STEP HOW YOU SHOULD INSTALL THE P&D VALVE. INCLUDE ALL SAFETY PRECAUTIONS THAT YOU SHOULD FOLLOW. YOU MAY USE THE ENGINE, THE P&D VALVE, AND ANY TOOLS THAT YOU WOULD NORMALLY USE TO SHOW ME HOW THE VALVE SHOULD BE INSTALLED.

Performed or Answered Correctly	Yes	No
Did the incumbent say he/she would:		
1. Lubricate the O-rings and seal with petrolatum prior to installation?	___	___
2. Install the large elbows, jam nuts and O-rings in the large outlet ports and rear port?	___	___
3. Leave the jam nuts finger tight until after the fuel manifolds were installed?	___	___

RATER TRAINING PROGRAM

Administrator's Guide

HAND OUT RATER TRAINING BOOKLETS, THEN SAY: WE ARE GOING TO BEGIN THE RATER TRAINING SESSION. PLEASE TURN TO PAGE 1 AND FOLLOW ALONG WHILE I READ OUT LOUD. PLEASE DO NOT MARK IN THE BOOKLETS.

I. Introduction

For the next several hours, your time will be spent focusing on the rating forms you will complete as part of this research project. You will use several rating forms to rate the performance of yourself, your coworkers, or if you are a supervisor, your subordinates.

Before you use any of the rating forms, we are going to talk about each form, its purpose, and how to use each form to effectively rate an individual. We are also going to discuss some ideas that will help you use the rating forms and make the most accurate ratings possible.

It is essential to the outcome of this project that you be truthful and honest in your ratings. The ratings will not be seen by your coworkers, supervisor or anyone else connected with your unit. The data collected will be seen only by Navy Personnel Research and Development personnel and the private contractor associated with this project. The information you provide will be coded to assure confidentiality and the rating forms will subsequently be destroyed. The ratings will be used for research purposes only and will in no way effect anyone's career. Therefore, please rate each person as accurately as possible.

Performance Factor 1 (PF1): Technical Knowledge/Skill

Displaying job knowledge and skill.

Levels	Circle the Number	Behavioral Examples
Always exceeds acceptable level of performance	5	Displays exceptional knowledge/skill to consistently complete assignments and tasks properly; requires little or no supervision; completes tasks in minimum time.
Frequently exceeds acceptable level of performance	4	Displays considerable knowledge and skill to complete assignments and tasks properly; performs effectively with little supervision; completes tasks quicker than average first-term sailors or marines.
Meets acceptable level of performance	3	Displays good knowledge/skill in most aspects of the job; able to properly complete the majority of tasks; requires supervision only on difficult tasks and assignments; completes work in the same time as other first-term sailors or marines.
Occasionally meets acceptable level of performance	2	Occasionally displays adequate knowledge about how to complete tasks and assignments; quality of work is inconsistent; requires direct supervision on most tasks to ensure quality and accuracy; usually completes tasks within required time.
Never meets acceptable level of performance	1	Does not display knowledge and skill necessary to properly complete tasks and assignments; unable to perform without direct supervision; often fails to complete assignments; performs slower than other first-term sailors or marines.

SCENARIO FOR TASK 360: You have been instructed to install the exhaust gas thermocouple harness.

9. (I052) **Which of the components (A,B,C) in the picture to the left is the EGT thermocouple harness. Write the matching letter on the answer sheet.**

10. From the list below, select the actions or checks that you should take when installing the EGT thermocouple harness. Place a checkmark in the yes column of the answer sheet if you should perform the action. Place a checkmark in the no column if you should not perform the action.

(I053) **Ensure that no burrs remain on the threads or mating surface of the turbine frame boss.**
(I054) **Ensure that no lubricant ran into the filler material around the thermocouple loops at the ends of the probes.**
(I055) **Apply a thin coating of lubricant on the threaded areas of each thermocouple boss on the turbine frame.**
(I056) **Torque each nut as each probe is installed.**
(I057) **Ensure that the harness did not bend causing the inside filament to be broken.**
(I058) **Install a copper gasket between the top harness and the lead.**
(I059) **Connect the forward end of each harness to the rigid thermocouple lead.**
(I060) **Safety wire each thermocouple harness mounting boss to a turbine case flange bolt.**

GENERAL UTILITY/ACCEPTABILITY QUESTIONNAIRE FOR THE NAVY/MARINE CORPS J-79 JET ENGINE MECHANIC PERFORMANCE ASSESSMENT SYSTEM

NAME_____ **SSN**_____

We are interested in your beliefs about the usefulness of the entire performance measurement system (i.e., rating forms, hands on testing, interview testing, and job knowledge test with photographs) as well as your beliefs about how the performance information will be used. Please respond to questions 1 through 6 by using the scale below.

1 = Not at all
2 = To a small extent
3 = To a moderate extent
4 = To a great extent
5 = To a very great extent

---

1. How much do you believe each measuring instrument will allow someone to correctly determine your level of job proficiency?

_____ Rating Forms

_____ Hands-On Tests

_____ Interview Tests

_____ Job Knowledge Test

2. How acceptable (i.e., easy to use and understand) do you believe each measuring instrument is as a means of determining job proficiency?

_____ Rating Forms

_____ Hands-On Tests

_____ Interview Tests

_____ Job Knowledge Tests

3. How motivated were you to complete each measuring session?

_____ Rating Forms

_____ Hands-On Tests

_____ Interview Tests

_____ Job Knowledge Tests

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